

## METHYL BROMIDE USE RATE REDUCTIONS AND EFFECTS ON NEMATODE CONTROL AND TOMATO YIELD

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Given the importance of methyl bromide (MBC) to Florida agriculture and apparent conflict of continued MBC use with federally mandated clean air standards, it was imperative that the ways and means of reducing levels of methyl bromide usage in agriculture were identified. Reducing dosage was considered as an alternative approach to reducing the net impact of manmade sources of methyl bromide on ozone destruction rather than a complete ban on use and production. Preliminary assessment of changes in current methyl bromide use practices in agriculture suggested that bed emissions and application dosages could be significantly reduced below current levels. For example, reducing the width of the raised plant bed from 91 to 61 cm could immediately reduce use rates by 33% in some crops because 2 chisels instead of 3 would be required to fumigate plants beds. Using thicker or new gas-tight plastic mulch row covering materials in combination with MBC formulations with increased chloropicrin content could also reduce application rates an additional 25-50%. With these relatively simple modifications the dissipation rate of gases into the air could be minimized, while hopefully still subjecting soil pests to lethal cumulative levels of methyl bromide. The studies which have been conducted and summarized here therefore had as their primary objective to reduce methyl bromide application rates for soil fumigation uses, relative to current practices, by at least 50%, utilizing lower application rates, narrower bed dimensions, and use of less permeable plastic mulch bed covering materials.

### MATERIALS & METHODS

Four experiments were conducted at field locations in Lake Alfred, Quincy, and Ft. Lonesome Florida during the fall of 1992 and spring of 1993. Two of the three sites had previous history of severe root-knot nematode and weed infestation. In all experiments at least 4 treatments were evaluated (Table 1). As the commercial standard reference treatment (RT-Treatment 1), a white / black laminated polyethylene plastic film (1.5 mil, with a permeation constant to methyl bromide of 12.2) was sealed over the plant beds immediately following MBC soil fumigation at a broadcast equivalent rate of 412 kg a.i./ha. Treatment 2, and in some cases treatment 3, utilized a white, highly methyl bromide impervious (1 mil, PC=2.6-4.8) polyethylene plastic film (Experimental unit# XUR-1551-3619-6, **DOW** Chemical Film Division, Fresno, CA) with MBC broadcast

equivalent rates of 206 and 103 kg a.i./ha. All methyl bromide treatments with the exception of treatment 3 at Ft. Lonesome which was a half rate of 67/33, was a formulation of 98% methyl bromide and 2% chloropicrin. In all cases, methyl bromide was soil injected using a Wallace and Tiernan proportionate flow meter calibrated to apply MBC at 100, 50, or 25% of the standard broadcast equivalent rate of 412 kg a.i./ha.

#### RESULTS

Table 1 attempts to summarize pest and crop yield responses relative to the standard commercial methods and rates of methyl bromide application. Without exception, use of MBC at a reduced rate of half (50%) or even one quarter (25%) of the standard broadcast rate was sufficient to provide equivalent nematode control and reduction of final harvest root gall severity levels caused by the root-knot nematode, Meloidogne incognita (Table 1). Effective and equivalent weed control was achieved at rate reductions of 50% but not in all cases at 75%. Loss of weed control was also observed in Quincy when a half dose of MBC was applied under standard 1.5 mil white/black polyethylene plastic mulch. In this case weed control was intermediate to that of the standard full rate of MBC and that of the untreated control. Tomato crop yields were equivalent, or in some cases (Lake Alfred, fall 1992) significantly higher than the commercial standard reference treatment and the untreated control.

#### DISCUSSION

The results from these experiments demonstrate that it is possible to significantly reduce methyl bromide applications rates by as much as 50-75% without serious consequence to crop yields or nematode control. These reductions however appear only to be possible when combined with the use of the more impervious plastic mulch covers. The level to which weed or disease control may have to be complemented by other alternative measures to insure tomato crop yields without significant loss due to these pests is not known. Of particular concern was the unsatisfactory weed control at the lowest levels of MBC use. It should also be recognized that the more impervious cover may not alter total proportionate escape but may only retard the rate of gaseous diffusion of MBC from the mulch covered bed. It would appear that the slower rates of escape ultimately translated into the lethal, near equivalent levels of nematode control that was observed. It is also not clear to what extent the price of the new, less permeable plastic mulch will contribute to tomato production costs.

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Table 1. Crop and pest control responses observed at four Florida field locations during 1992-93 evaluating possible methyl bromide rate reductions utilizing lower application rates, narrower bed dimensions and use of less permeable plastic mulch bed covering materials.

Experiment Location	MBC Treatment	Mulch Type	PF	Treatment Response*		
				Nematode Control	Weed Control	crop Yield
<u>Lake Alfred, Fall 1992 - Tomato</u>						
	1X	Standard	12.2	0	0	0
	.5X	Experimental	4.8	0	0	+
	.25X	Experimental	4.8	0		+
	OX - Control	Standard	12.2			
<u>Lake Alfred, Spring 1993 - Tomato</u>						
	1X	Standard	12.2	0	0	0
	.5X	Experimental	4.8	0	0	0
	.25X	Experimental	4.8	0	0	0
	OX - Control	Standard	12.2			
<u>Quincy, Spring 1993 - Tomato</u>						
	1X	Standard	12.2	0	0	0
	.5X	Experimental	4.8	0	0	0
	.5X	Standard	12.2	0	0,-	0
	OX - Control	Standard	12.2			0
<u>Ft. Lonesome, Spring 1993 - Squash</u>						
	1X	Standard	12.2	0	0	0
	.5X (98/2)	Experimental	4.8	0	0	0
	.5X (67/33)	Experimental	4.8	0	0	0
	OX - Control	Standard				

\*0 indicates no significant difference from standard commercial maximum broadcast rate equivalent of methyl bromide

+ indicates superior to standard MBC treatment

- indicates significantly inferior to standard treatment